

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 07-021522

(43)Date of publication of application : 24.01.1995

(51)Int.Cl.

G11B 5/31

(21)Application number : 05-189408

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(22)Date of filing : 30.06.1993

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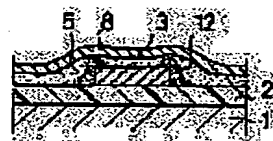
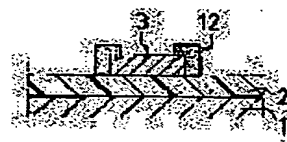
KUHARA MASAKAZU

(54) PRODUCTION OF THIN-FILM MAGNETIC HEAD

(57)Abstract:

PURPOSE: To secure the insulation between a conductor coil film and a magnetic film by forming a narrow-strip insulating layer around the magnetic film and then laminating an insulating film and the conductor film.

CONSTITUTION: A lower magnetic film 3 is formed on an insulating film 2 on a substrate 1, an insulating layer is provided around the film 3, the upper edge is ground to remove the angular part, hence a narrow-strip insulating layer 12 is formed, and the upper end of the film 3 is substantially rounded. Consequently, an insulating film 5 having a sufficient thickness even on the end edge of the film 3 is formed, and a conductor coil 8 forming a magnetic circuit with the film 3 is laminated on the film 5, and the insulation between the films 3 and 8 is sufficiently secured. As a result, the insulation resistance and dielectric breakdown voltage between the magnetic-pole coils are increased, and a highly reliable thin-film magnetic head is obtained.



LEGAL STATUS

[Date of request for examination] 30.06.1993

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number] 2649209

[Date of registration] 16.05.1997

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right] 16.05.2000

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CLAIMS

[Claim(s)]

[Claim 1] It is the manufacture approach of the thin film magnetic head of having the magnetic circuit which consists of coil film, the magnetic film formed on the substrate, and the conductor formed through the insulator layer on it — The manufacture approach of the thin film magnetic head characterized by including the process which forms a partial and narrow-width insulating layer at least along the perimeter of said magnetic film on said substrate, and the process which forms said insulator layer on them so that said narrow-width insulating layer and said narrow-width magnetic film may be included.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the manufacture approach of the thin film magnetic head used for a magnetic disk drive and other magnetic recorder and reproducing devices.

[0002]

[Description of the Prior Art] Conventionally, with high-performance-izing of a magnetic disk drive, in order to aim at improvement in recording density and an information transfer rate, the thin film magnetic head is adopted. Generally, manufacture of the thin film magnetic head is performed using deposition techniques, such as electroplating and sputtering, and the ultra-fine processing technology by photolithography.

[0003] The structure of the well-known thin film magnetic head for the record playback within a field is roughly shown in drawing 5 and drawing 6 from the former. The insulator layers 2, such as an alumina, are put on the substrate 1 which consists of a ceramic ingredient of an aluminum₂O₃-TiC system etc., and the lower magnetic film 3 which constitutes a lower magnetic pole is formed on it. the spiral conductor which consists of insulator layers 5, 6, and 7 which the gap film 4 which consists of an alumina etc. is formed on the lower magnetic film 3, and consist of organic insulation resin ingredients, such as novolak resin, on it, Cu, etc. — the laminating of coils 8 and 9 and the up magnetic film 10 is carried out one by one. Furthermore, on the up magnetic film 10, the protective coats 11, such as an alumina, are formed of sputtering etc. Thus, the formed thin film magnetic-head component is started from a substrate, and it carries in each slider, and is used as the thin film magnetic head.

[0004]

[Problem(s) to be Solved by the Invention] According to the conventional technique, said insulator layer applies and carries out software BEKU of usually, for example, the novolak resin, and is formed by applying, exposing, developing, heat-treating and stiffening a photo mask. Since novolak resin is contracted by BEKU [the fluidity by heat / have and], as is shown in drawing 7, in the 1st insulator layer 5, the thickness near the edge of the lower magnetic film 3 becomes very thinly especially with the level difference of the lower magnetic film 3 and a substrate 1. the upper bed of the lower magnetic film 3 with which the thickness of an insulator layer 5 becomes the thinnest [drawing 8], and a conductor — the relation between the distance D with a coil 8, and the withstand voltage of an insulator layer — an experimental result — being based — a diagram — a table — it is a thing the bottom. From this drawing, in this experiment, if distance D is set to 1 micrometer or less, it will be understood easily that withstand voltage fell rapidly. Thus, there was a problem that there was a possibility that record playback of the information the insulation resistance and dielectric breakdown voltage between magnetic pole coils fall without maintaining sufficient insulation if a coil 8 and the lower magnetic film 3 approach too much by part for the edge the 1st conductor, and according to a thin film head formed on the 1st insulator layer 5 may not be performed normally.

[0005] Moreover, since the standup include angle for a point of the up magnetic film 10 would become very sudden although the thickness of the 1st insulator layer 5 in near the periphery of the lower magnetic film 3 is fully securable if the 1st insulator layer 5 whole is formed more thickly, the internal stress of the protective layer 11 formed on it became large, the crack etc. occurred, and there was a possibility of reducing dependability.

[0006] Then, the manufacture approach of the thin film magnetic head according to claim 1 The place which it is made in view of the trouble of the conventional technique mentioned above, and is made into the object According to a comparatively easy process, also in a part for the edge of the magnetic film formed on a substrate The thickness of the insulator layer formed on it is fully secured, without making a protective layer generate a crack etc. a magnetic film and a conductor — good insulation can be secured between coil film, dielectric breakdown voltage tends to be made high, and it is going to offer the manufacture approach of the thin film magnetic head which can raise dependability.

[0007]

[Means for Solving the Problem] This invention is for attaining the object mentioned above. The manufacture approach of the thin film magnetic head according to claim 1 In manufacture of the thin film magnetic head which has the magnetic circuit which consists of coil film the magnetic film formed on the substrate, and the conductor formed through the insulator layer on it — After forming a partial and narrow-width insulating layer at least along the perimeter of a magnetic film on a substrate, it is characterized by forming an insulator layer on them so that this insulating layer and magnetic film may be included.

[0008]

[Function] Therefore, also in a part for the edge of a magnetic film, the thickness of an insulator layer is fully

securable in spite of the level difference of a substrate and a magnetic film according to the thin film magnetic-head manufacture approach according to claim 1 by preparing an insulator layer in piles on the narrow-width insulating layer formed along the perimeter of a magnetic film.

[0009]

[Example] It explains to it using an example, referring to an accompanying drawing to below about this invention.

[0010] The manufacture approach of the thin film magnetic head for the record playback within a field by this invention is first explained using drawing 1 and drawing 2. On the substrate 1 on which the insulator layers 2, such as an alumina, were made to put, pattern formation of the lower magnetic film 3 which consists of soft magnetic materials, such as a nickel-Fe alloy and a cobalt alloy, is carried out by the usual technique, such as lithography, electroplating, sputtering, and etching, like the conventional technique mentioned above. Although not illustrated, on the substrate 1, the gap film 4, such as an alumina, is formed of sputtering including the lower magnetic film 3. In this condition, as shown in drawing 1 -A, that edge is slightly applied to wrap band-like for the narrow-width insulating layer 12 which consists of organic insulation resin ingredients, such as novolak resin, along the perimeter of the lower magnetic film 3. a part for the point of the lower magnetic film 3 which constitutes a lower magnetic pole so that this insulating layer 12 may be well shown in drawing 2 — removing — at least — a it top — a conductor — what is necessary is just to prepare in the field in which coils 8 and 9 are formed

[0011] Next, since novolak resin also has a fluidity with heating when software BEKU of this organic insulating layer 12 is carried out, as shown in drawing 1 -B, an insulating layer 12 is formed in that perimeter so that it may hang down from the edge of the lower magnetic film 3. Thus, on the formed insulating layer 12 and the lower magnetic film 3, as usual, organic insulation resin, such as novolak resin, is applied and (drawing 1 -C) heat-treated, and an insulator layer 5 is formed (drawing 1 -D). next, it is shown in drawing 1 -E — as — the technique usual to an insulator layer 5 top — a conductor — pattern formation of the coil 8 is carried out. although the part of the insulating-layer 12 neighborhood of an insulator layer 5 becomes thin by heat treatment, an insulating layer 12 exists — a conductor — between a coil 8 and the lower magnetic film 3, sufficient insulation is secured also in the circumference part. furthermore, a conductor — a coil 8 top — interlayer insulation films 6 and 7 — the laminating of a coil 9 and the up magnetic film 10 is carried out the 2nd conductor, and a protective layer 11 is formed, and the thin film magnetic head is completed.

[0012] Next, drawing 3 and drawing 4 explain another example of this invention. At this example, it is drawing 3. — As shown in A and drawing 4, the narrow-width band-like insulating layers 13, such as novolak resin, are formed in the perimeter of the lower magnetic film 3 with few clearances. this time — an insulating layer 13 — the lower magnetic film 3 and abbreviation — although it has the same height, when the height after heat treatment becomes low too much as compared with the lower magnetic film 3 and forms an insulator layer 5 on it, unless sufficient insulation is no longer secured, even if it makes it lower than the lower magnetic film 3, it does not interfere.

[0013] Software BEKU of the insulating layer 13 is carried out like the case of the 1st example of the above. Between the insulating layer 13 and the lower magnetic film 3, as mentioned above, the clearance is prepared slightly, but when novolak resin has a fluidity with heating, an insulator layer 13 is formed so that the end face of the lower magnetic film 3 may fully be touched, as shown in drawing 3 -B. next, it is shown on these at drawing 3 -C thru/or drawing 3 -E — as — an insulating layer 5 and a conductor — sequential formation of the coil 8 is carried out. although in the case of this 2nd example an insulator layer becomes thin in near the edge of the lower magnetic film 3 since the insulating layer 13 is small as compared with the insulating layer 12 of the 1st example — the lower magnetic film 3 and a conductor — extent with which insulation with a sufficient coil 8 may be maintained is isolated.

[0014] In addition, even if it is prepared in this invention so that it may have a clearance so that insulating layers 12 and 13 may lap with the periphery of the lower magnetic film 3 or so that the 1st and 2nd examples of the above may show, the desired operation effectiveness can be acquired similarly. Therefore, since it is not necessary to arrange to accuracy to a lower magnetic film beyond the need, an insulating layer can be formed comparatively easily.

[0015] This invention is not limited to the above-mentioned example, and can add and carry out various deformation and modification within the technical limits. For example, although the above-mentioned example is related with the manufacture approach of the thin film magnetic head for the record playback within a field, it is applicable similarly about the thing for vertical recording playback. Moreover, although insulating layers 12 and 13 were formed in the perimeter part except a part for the point of the lower magnetic film 3, even if it prepares only along with the both-sides section of a lower magnetic film, the same operation effectiveness is acquired. Moreover, although novolak resin was used as an insulating material, it cannot be overemphasized that other various organic insulation resin ingredients can be used.

[0016]

[Effect of the Invention] Since this invention is constituted as mentioned above, it does so effectiveness which is indicated below.

[0017] Since the insulator layer which has sufficient thickness also in a part for the edge of a magnetic film can be formed according to the comparatively easy process in spite of the level difference of a substrate and a magnetic film according to the manufacture approach of the thin film magnetic head according to claim 1 a conductor — the distance of the coil film and a lower magnetic film is fully secured, good insulation can be secured among them, the insulation resistance between magnetic pole coils is increased, and the thin film magnetic head which raised dependability with high dielectric breakdown voltage can be offered.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the sectional view in which it becomes from A drawing thru/or E drawing, and is shown like the formation fault of the insulating layer by the 1st example of this invention.

[Drawing 2] It is the top view of drawing 1 -A.

[Drawing 3] It is drawing in which it becomes from A drawing thru/or E drawing, and is shown like the formation fault of the insulating layer by the 2nd example of this invention.

[Drawing 4] It is the top view of drawing 3 -A.

[Drawing 5] It is the outline perspective view showing the structure of the conventional thin film magnetic head.

[Drawing 6] It is drawing of longitudinal section of the thin film magnetic head shown in drawing 5 .

[Drawing 7] It is a sectional view in the VII-VII line of drawing 5 .

[Drawing 8] the upper bed of a lower magnetic film, and a conductor — it is a diagram showing the relation between the distance D between coils, and the withstand voltage of an insulator layer.

[Description of Notations]

1 Substrate

2 Insulator Layer

3 Lower Magnetic Film

4 Gap Film

5, 6, 7 Insulator layer

8 and 9 a conductor — coil

10 Up Magnetic Film

11 Protective Layer

12 13 Insulating layer

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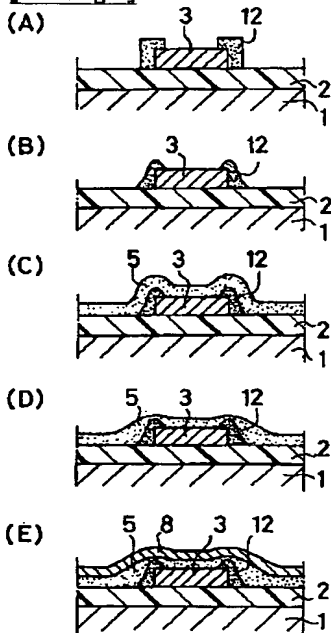
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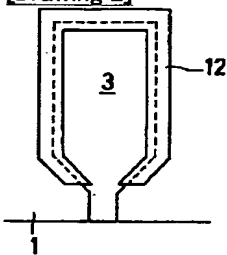
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DRAWINGS

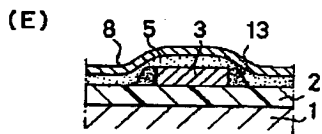
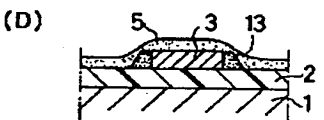
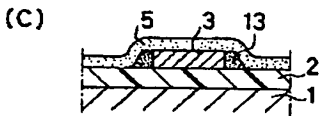
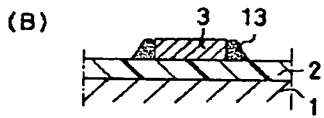
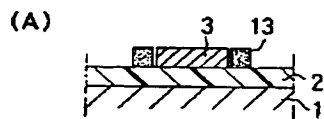
[Drawing 1]



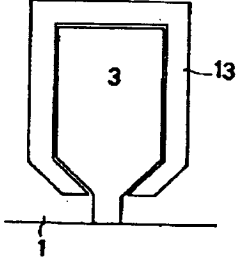
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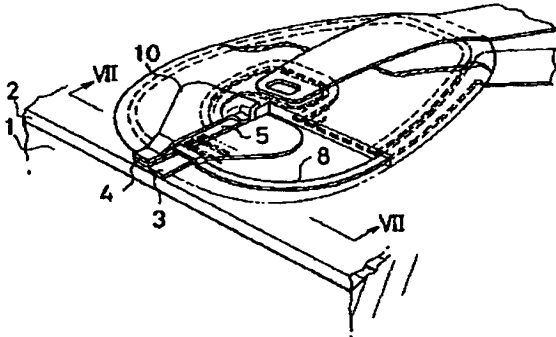
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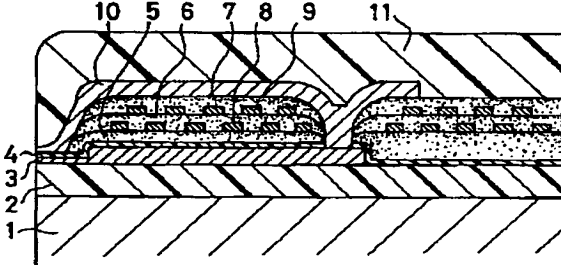
[Drawing 4]



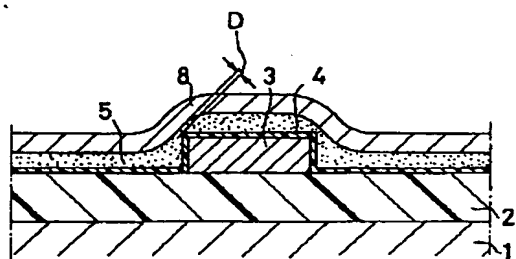
[Drawing 5]



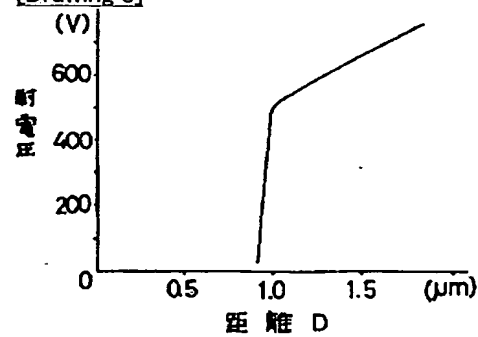
[Drawing 6]



[Drawing 7]



[Drawing 8]



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